High-Power Q-Switched Diode-Pumped UV Laser

Q-Series®: Q305 and Q306

The high-power Q305 and Q306 lasers expand the existing Q-Series to provide solutions for demanding applications that require faster throughput.

JDSU Q-Series lasers continue to lead the high-power Q-switched diode-pumped UV laser market used for a wide variety of high-precision micromachining applications. Whether for high-pulse-energy processing of materials such as ceramics, high-repetition-rate processing of materials such as sapphire or silicon, or patterning thin-film solar cells, the Q-Series lasers deliver unsurpassed performance combined with industry-leading uptime.

Due to intracavity UV harmonic generation's self-stabilizing characteristics, all Q-Series lasers exhibit inherently high energy, high pulse-to-pulse stability, and long-term output power stability. In addition, the excellent thermal management of the unique Nd:YAG-based side-pumped architecture achieves excellent beam quality over wide ranging operating conditions and maintains exceptionally stable beam position and profile, which is important for processes requiring accurate feature placement. These advantages enable Q-Series lasers to achieve the tightest possible process tolerances for micromachining and other materials-processing applications.

Key Features

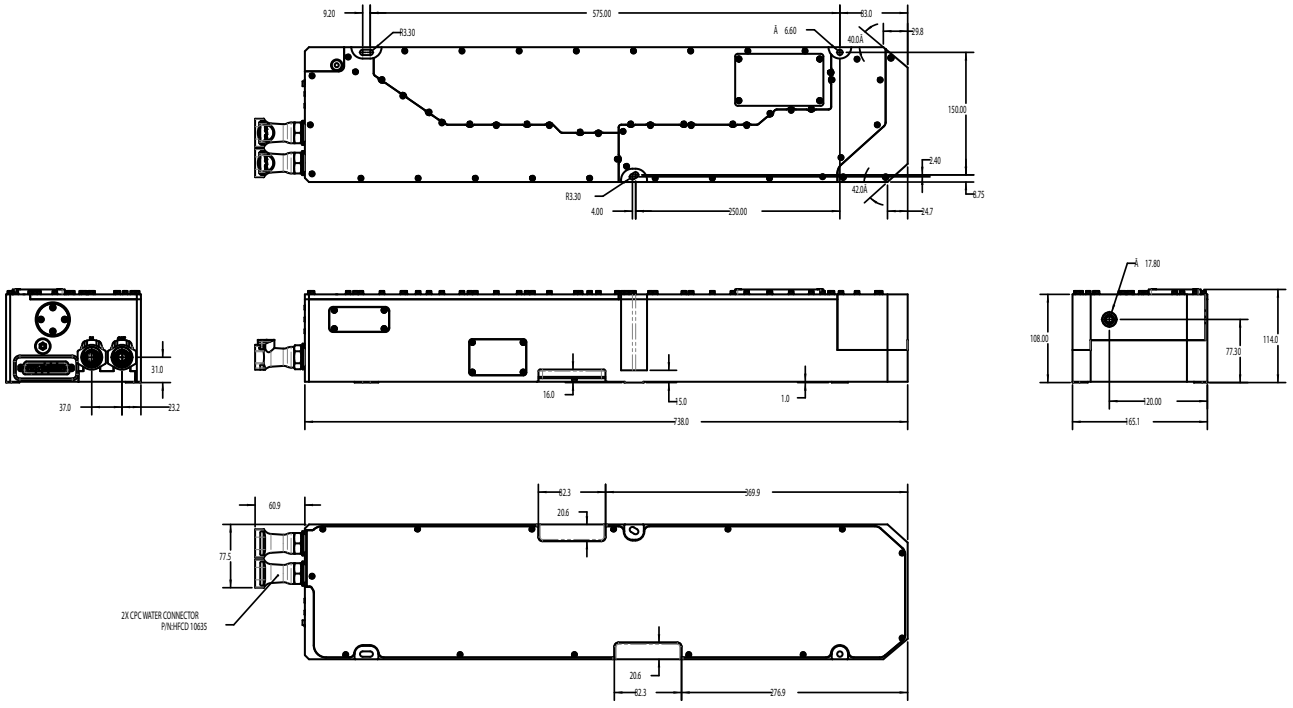
- Higher throughput enabled by more than 40 W of UV output power
- Highest UV energy (1 mJ) available on the market with M^2 better than 1.2
- Capable of processing the widest range of materials due to a large selection of pulse energies, pulse widths, and repetition rates
- High reliability due to low fluence in harmonic crystals and no cavity optic coatings exposed to UV
- Tighter process control due to superior energy stability enabled by unique intracavity harmonic generation
- Customization available upon request

Applications

- Wafer scribing
- Full-cut wafer dicing
- Low-k dielectric grooving
- Micromachining of silicon, sapphire, ceramics, and metal
- Micro-via drilling
- PCB and flexboard cutting

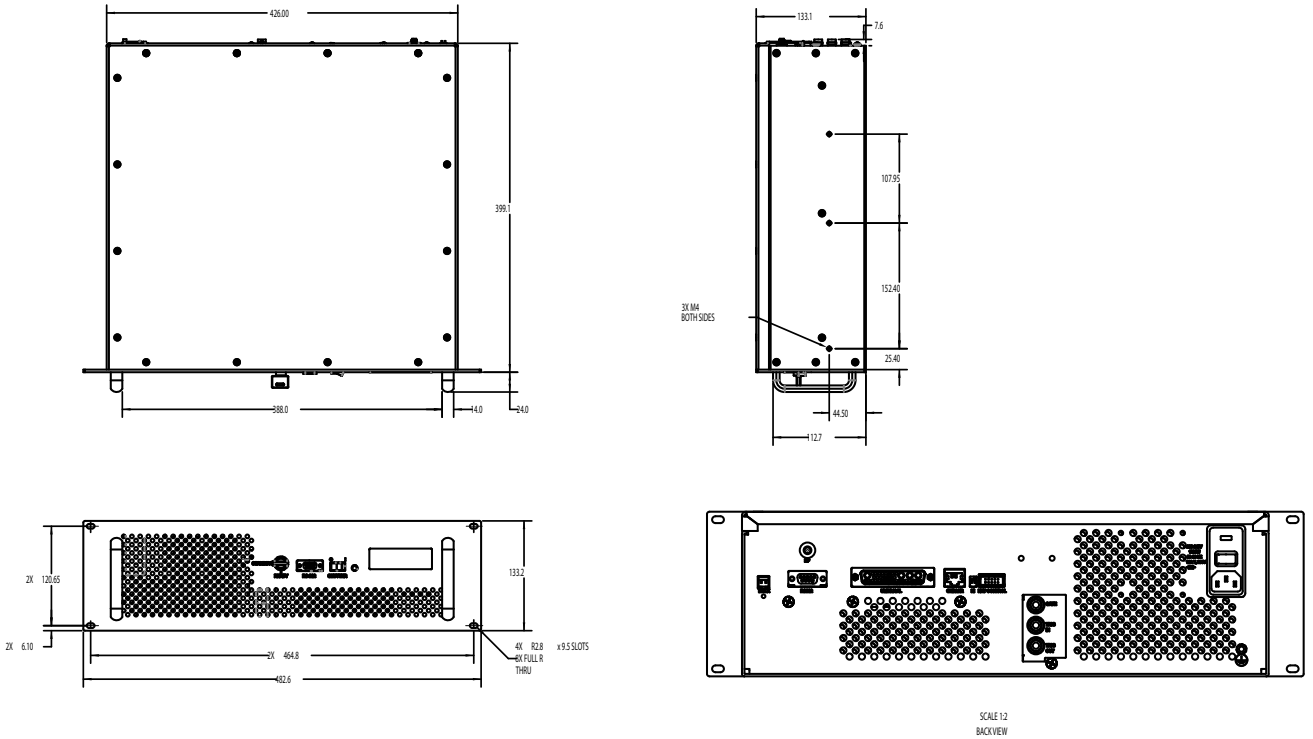
Q-Series 355 nm Laser Head

Specifications in millimeters unless otherwise noted. Dimensions include mounting pads. Feet screw locations match 25 mm and 1 inch grid.



Power Supply

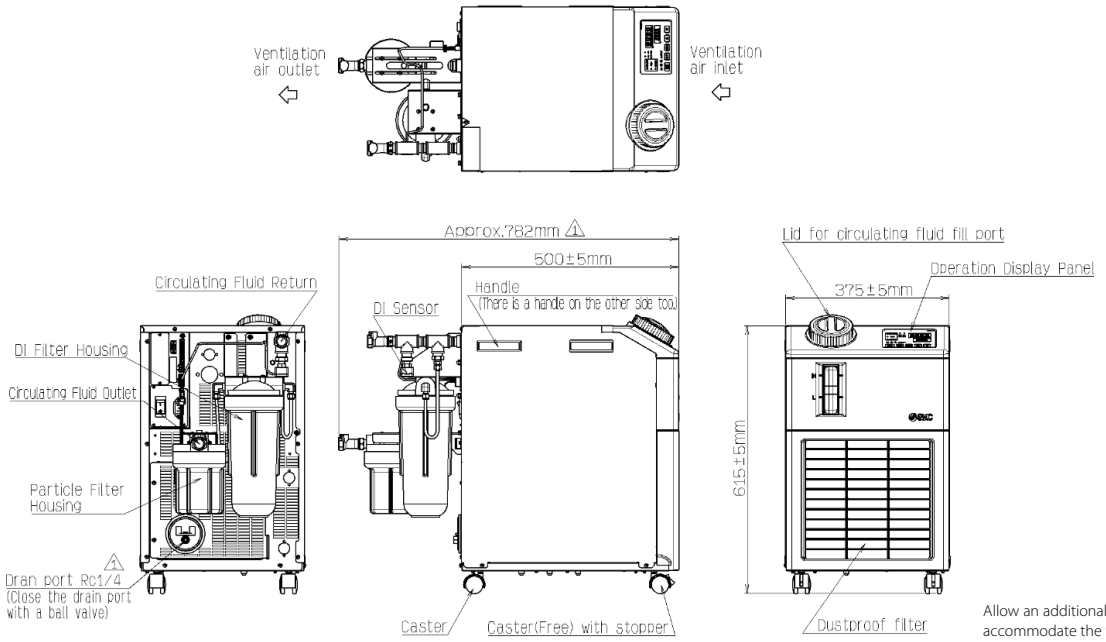
Specifications in millimeters unless otherwise noted. Dimensions include mounting pads.



Chillers

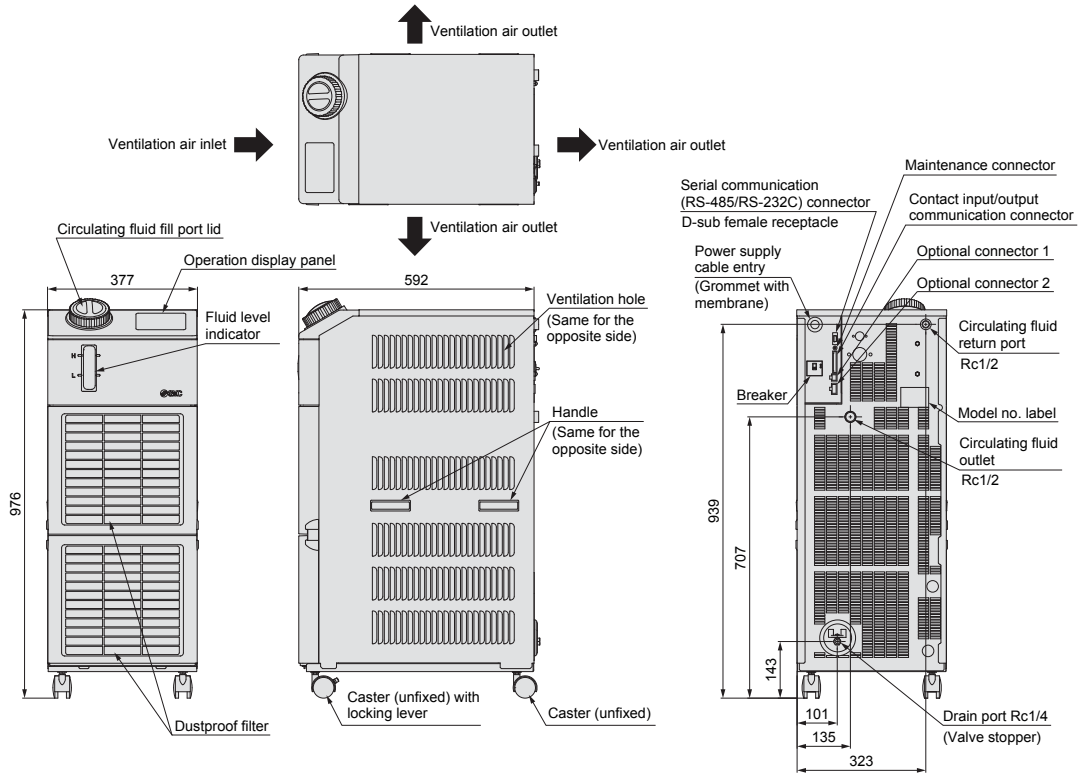
Specifications in millimeters unless otherwise noted. Dimensions include mounting pads.

Q5-CH



Allow an additional 2 in clearance on the back of the chiller to accommodate the water hose connection.

Q6-CH



Allow an additional 2 in clearance on the back of the chiller to accommodate the water hose connection.

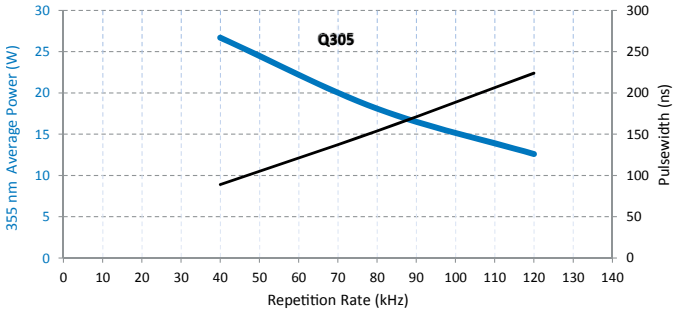


Figure 1. Q305 typical power and pulse width curve

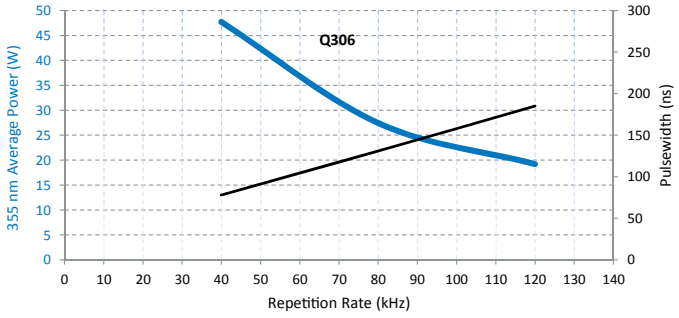


Figure 2. Q306 typical power and pulse width curve

Specifications

Q-Series Laser Head Parameters		Q305-HD-1000R	Q306-HD-1000R
Wavelength		354.7 nm	354.7 nm
Polarization		>100:1, horizontal	>100:1, horizontal
Spatial mode		TEM_{00}	TEM_{00}
M-squared[1]		<1.2	<1.2
Waist location (internal, from beam exit)		605 mm nominal	575 mm nominal
Waist diameter, $1/e^2$ (see footnote 1)		0.245 mm nominal	0.3 mm nominal
Beam roundness[1,2]		90% typical	90% typical
Beam divergence, full angle[1]		2.0 mrad nominal	1.6 mrad nominal
Pointing drift, over 8 hours, full angle[3]		<50 µrad	<50 µrad
Beam position accuracy, unit to unit		<2.5 mm from nominal	<2.5 mm from nominal
Beam pointing accuracy, unit to unit		<17.5 mrad from nominal	<17.5 mrad from nominal
Controller repetition rate	Internally triggered	1 kHz to 250 kHz	1 kHz to 250 kHz
	Externally triggered	0 kHz to 250 kHz	0 kHz to 250 kHz
Constant pulse energy range[6]		40 kHz	40 kHz
Average output power	At 40, 80, 120 kHz	≥22.0, 14.4, 10.4 W	≥40.0, 20.0, 12.0 W
Pulse width[4]	At 40, 80, 120 kHz	80 ±30,135 ±60, 190 ±90 ns	70 ±20, 120 ±20, 160 ±60 ns
Power drift over 8 hours[3]		<±2%	<±2%
Warm-up time[5]	From cold start	<20 minutes	<20 minutes
	From standby	<10 minutes	<10 minutes
Operating ambient temperature		15 to 35°C	15 to 35°C
Relative humidity, noncondensing		10 to 80%	10 to 80%
Weight		17.7 kg	18.6 kg

1. Specification holds over different repetition rate ranges, depending on the laser model.
2. Defined as minor axis divided by major axis.
3. Ambient temperature constant ±2°C.
4. FWHM pulse duration measured according to method detailed in JDSU application note titled "Optical Pulse Width Measurement Techniques for Q-Series Lasers."
5. Time until laser meets all specifications. Laser will function almost immediately after turning on, but may not immediately meet all specifications.
6. Refer to the rep rate where the energy is clamped.

Q-Series Power Supply Parameters	Q5-PS-1000R	Q6-PS-1000R
Front panel/display	Power on/off key	Power on/off key
	Shutter open/closed switch (status LED)	Shutter open/closed switch (status LED)
	Status display (4 line x 20 character)	Status display (4 line x 20 character)
	RS232 serial port connector (9-pin D-sub)	RS232 serial port connector (9-pin D-sub)
Rear panel	RS232 serial port connector (identical to front panel)	RS232 serial port connector (identical to front panel)
	Interlock connector (2-pin, 0.1" spacing)	Interlock connector (2-pin, 0.1" spacing)
	Q switch RF connector (SMA connector)	Q switch RF connector (SMA connector)
	Umbilical connector (multi-pin D-shaped)	Umbilical connector (multi-pin D-shaped)
	Chiller communication port (RJ45)	Chiller communication port (RJ45)
	Emission indicator connector (2-pin, 0.1" spacing)	Emission indicator connector (2-pin, 0.1" spacing)
	External control port (10-pin 3M-style)	External control port (10-pin 3M-style)
	Slot for optional standard or custom interface board (standard with 3 BNC connectors)	Slot for optional standard or custom interface board (standard with 3 BNC connectors)
	Ground pin	Ground pin
	Fuse holder	Circuit breaker
	Power switch	Power switch
	Power-cord connector	Power-cord connector
Weight	30.9 lbs (14 kg)	30.9 lbs (14 kg)
Umbilical cable length	10 ft (3 m), 16.4 ft (5 m), 23.3 ft (7 m)	10 ft (3 m), 16.4 ft (5 m), 23.3 ft (7 m)
Input and Ambient		
Voltage, frequency	200 to 240 V AC, 50 – 60 Hz	200 to 240 V AC, 50 – 60 Hz
Power	<1600 W	<2600 W
Operating ambient temperature	15 to 35°C	15 to 35°C
Relative humidity, noncondensing	10 – 80%	10 – 80%
Storage temperature	–20 to 55°C	–20 to 55°C

Q-Series Chiller Parameters	Q5-CH	Q6-CH
Cooling capacity	>1000 W	>3000 W
Cooling method	Air-cooled refrigeration	Air-cooled refrigeration
Coolant	Resistivity controlled de-ionized water	Resistivity controlled de-ionized water
Reservoir volume	>3 l	>3 l
Coolant flow rate	≥2.5 GPM at 60 psi (at all filter outlets)	≥2.5 GPM at 35 psi (at all filter outlets)
Weight, reservoir empty	<99 lb (45 kg)	<154 lb (70 kg)
Hose length	3.0 m (9.8 ft) or 5.0 m (16.4 ft) or 7.0 m (23.0 ft)	3.0 m (9.8 ft) or 5.0 m (16.4 ft) or 7.0 m (23.0 ft)
Chiller control cable length	5.0 m (16.4 ft)	5.0 m (16.4 ft)
Input and Ambient		
Voltage, frequency	200 – 230 V AC, 50 – 60 Hz	200 – 230 V AC, 50 – 60 Hz
Power	<1 kVA	<2.2 kVA
Operating ambient temperature	15 to 35°C	15 to 35°C
Relative humidity, noncondensing	30 to 70%	30 to 70%
Storage temperature	0 to 50°C	0 to 50°C
Orientation	Upright position only	Upright position only

Regulatory Compliance

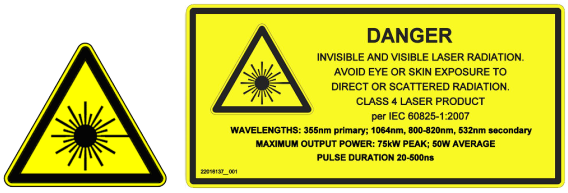
The Q305 and Q306 series laser heads use lead-free solder and are confirmed as RoHS 6/6 compliant. These laser heads also comply with international electromagnetic compatibility (EMC) and safety standards.

Product Certification	Standards and Regulations	Compliance Verification
Safety		
Electrical safety	UL 61010-1 3rd ed.	UL certified (recognized component) for US and CAN
	CSA C22.2 No. 61010-1 3rd ed.	
	EN 61010-1:2010	Compliant, test report by accredited safety test house
Laser safety	IEC/EN 60825-1:2007	Compliant, test report by accredited safety test house
	U.S. 21 CFR 1040.10	FDA/CDRH certified with accession number
CE marking	Low Voltage Directive 2006/95/EC	Compliant, Declaration of Conformity issued and CE marked
Electromagnetic Compatibility		
Radiated emissions and conducted emissions	EN 61000-6-4:2007 +A1:2011	Passes Class A digital device with a minimum –4 dB margin to the limit for conducted emissions and –9 dB margin for radiated emissions.
	IEC 61000-6-4:2006 +A1:2010	
	CISPR 11:2009 + A1:2010	
	FCC rules 47 CFR Part 18	Tested frequency range: 30 MHz to 1000 MHz for radiated emissions. Test report by accredited EMC test house
Harmonic currents	EN 61000-3-2:2006 +A1 +A2	Passes Class A, test report by accredited EMC test house
Voltage fluctuations and flicker	EN 61000-3-3:2008	Passes, test report by accredited EMC test house
Immunity	EN 61000-6-2:2005 +AC:2005	
	IEC 61000-6-2:2005	
Electrostatic discharge, ESD	EN 61000-4-2:2009	
Radiated immunity	EN 61000-4-3:2006 +A1 +A2	
Electrical fast transients	EN 61000-4-4:2004	
Surges	EN 61000-4-5:2006	
Conducted immunity	EN 61000-4-6:2009	
Voltage dips and interruptions	EN 61000-4-11:2004	
CE marking	EMC Directive 2004/108/EC	Compliant, Declaration of Conformity issued and CE marked
Environmental Compliance		
Restriction of hazardous substances, RoHS	EU Directive 2011/65/EU	Compliant per the Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (recast). A RoHS Certificate of Compliance (C of C) is available upon request. The product may use certain RoHS exemptions.

Laser Safety

The Q-Series Q305 and Q306 laser heads are Class 4 laser products per international standard IEC 60825-1:2007 2nd edition. As Class 4 laser products, the lasers output beam (invisible and visible) emitted from the laser head aperture is extremely hazardous.

The Q-Series Q305 and Q306 laser systems comply with 21 CFR 1040.10 except for deviations pursuant to Laser Notice No. 50 dated June 24, 2007.


DANGER
INVISIBLE AND VISIBLE LASER RADIATION.
AVOID EYE OR SKIN EXPOSURE TO
DIRECT OR SCATTERED RADIATION.
CLASS 4 LASER PRODUCT
per IEC 60825-1:2007
WAVELENGTHS: 355nm primary; 1064nm, 800-820nm, 532nm secondary
MAXIMUM OUTPUT POWER: 75kW PEAK; 50W AVERAGE
PULSE DURATION 20-500ns

Caution

Operating these products in a manner inconsistent with their intended usage and specifications may result in hazardous radiation exposure.

Use of controls or adjustments or performance of procedures other than these specified in this product data sheet or in the user's manual may result in hazardous radiation exposure.

Tampering with this laser product or operating this product outside the limits of this specification may be considered an 'act of manufacturing' and may require recertification of the modified product.

Warranty

JDSU diode-pumped Q-Series laser systems are warranted to be free of defects in materials and workmanship. Multiple warranty options are available.

Patent Information

The products described in this data sheet are based on JDSU Intellectual Property which includes more than 1,800 United States and foreign-registered patents. These patents are relevant to an extensive set of products and/or technology applications including JDSU laser products and associated technologies. For further information contact the JDSU Legal Department.

Ordering Information

For more information on these or other products and their availability, please contact your local JDSU account manager or JDSU directly at 1-800-498-JDSU (5378) in North America and +800-5378-JDSU worldwide, or via e-mail at customer.service@jdsu.com.

Description	Product Code
Laser Heads	
355 nm, 22 W class, 40 to 120 kHz	Q305-HD-1000R
355 nm, 40 W class, 40 to 120 kHz	Q306-HD-1000R
Accessories	
Power Supply	
Standard Q305 power supply	Q5-PS-1000R
Standard Q306 power supply	Q6-PS-1000R
Umbilical Cable	
3 meter flex umbilical cable	Q-PS-A30R
5 meter flex umbilical cable	Q-PS-A50R
7 meter flex umbilical cable	Q-PS-A70R
Chiller	
Standard Q305 chiller	Q5-CH
Standard Q306 chiller	Q6-CH
Hose Kit	
Pair of 3 m hoses, straight/straight couplings	Q5-CH-A33
Pair of 5 m hoses, straight/straight couplings	Q5-CH-A35
Pair of 7 m hoses, straight/straight couplings	Q5-CH-A37

Note: JDSU Q-Series portfolio covers a wide range of repetition rate from single shot up to 200 kHz. Custom models are available upon request.

Example for a complete Q305 system

Q305-HD-1000R (355 nm, 22 W, 40 to 120 kHz laser head)

Q5-PS-1000R (power supply)

Q-PS-A50R (5 m flex umbilical cable)

Q5-CH (standard chiller)

Q5-CH-A35 (5 m hose set, straight/straight couplings)

Example for a complete Q306 system

Q306-HD-1000R (355 nm, 40W, 40 to 120 kHz laser head)

Q6-PS-1000R (power supply)

Q-PS-A50R (5 m flex umbilical cable)

Q6-CH (standard chiller)

Q5-CH-A35 (5 m hose set, straight/straight couplings)

JDSU

North America Toll Free: 800 498-JDSU (5378)
Worldwide Tel: +800 5378-JDSU

www.jdsu.com

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